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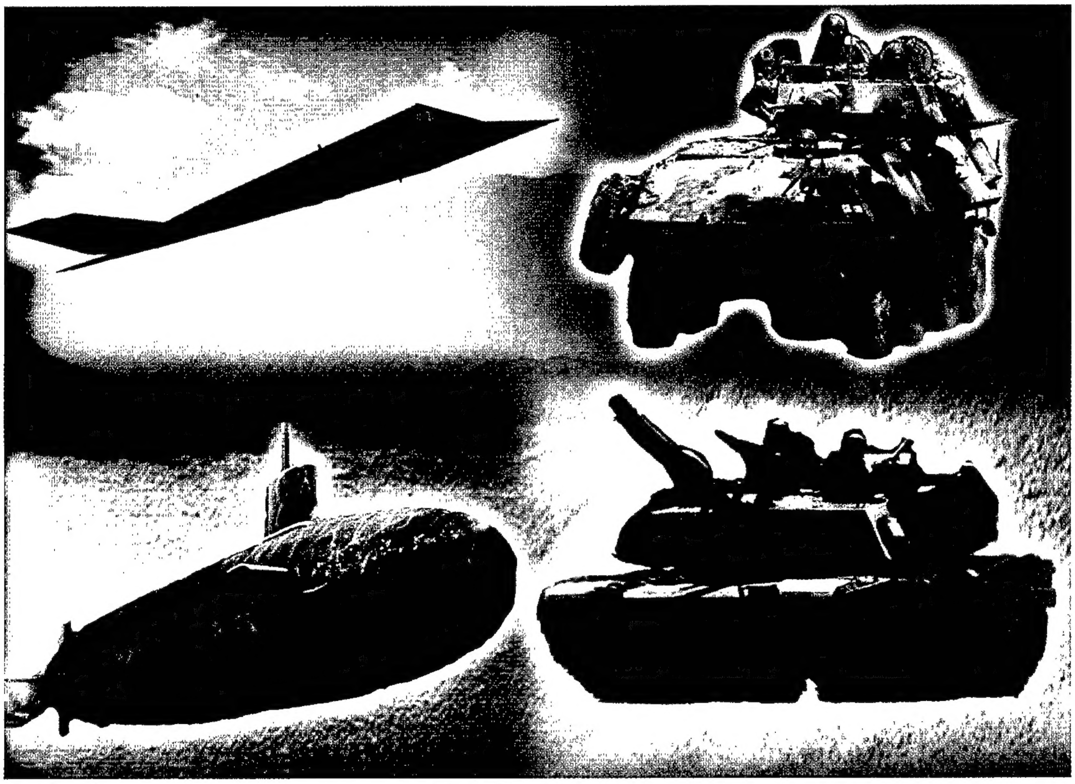

Photo illustration by Maria Candelaria

There are No Unmanned Systems

Paul H. Cunningham
Human Systems IAC

There are NO systems used by the United States (U.S.) military or the military of any other nation that are unmanned. All systems in some way require the direct or indirect contact of an operator, maintainer, or trainer. This simple statement identifies why Human Systems Integration (HSI) is so important. All military systems involve the human, and the requirements of the human affect the design of all military systems. The integration of the human into system design and the consideration of how the human and human requirements affect design is extremely important. On the average 50 to 60 percent of the life-cycle-cost of a military system is made up of costs associated with operating and maintaining the system and the cost for individuals that train the operators and maintainers. People drive total life-cycle-cost, not design or hardware.

This special issue of Gateway is dedicated to providing an overview of HSI. It contains articles from the Army, Navy, and Air Force on their HSI programs, an article from Canada outlining the Canadian Department of National Defense's approach to HSI, and an article from the University of Dayton outlining what one academic institution is doing to support HSI.

When you read the following HSI articles, note the similarities between what the individual services and Canada say about why a HSI program is needed and what they identify as requirements for a workable program. The U.S. military services and Canada

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express similar beliefs about the nature of conflicts they will fight in the future, as compared to those they fought in the past. The Army sees a need for an "Army transformation revolution," the Navy sees a "change in modern naval warfighting" resulting from new threats involving aggressive actions from smaller, more dispersed, highly mobile forces, and the Air Force sees a need to "shift attitudes and take the actions that HSI requires." All agree that tomorrows warriors will have to address more automation and technology, will have a limited amount of manpower to draw from, and will operate under reduced defense budgets. Along with these similarities, the articles also express similar ideas on what is required for an effective HSI program.

To have an effective and viable HSI program several things are critical. The DoD's Defense Technology Area Plan defines Human Systems this way: "provides technologies and methods to ensure that the military's most critical resource—its people—are properly selected, trained, and equipped to perform as effectively and safely as possible." The Canadian article expresses the sentiments of all the other articles when they identify that interviewed HSI specialists "support the initiatives, but need hard products to focus on." Their HSI initiative has three components:

1. People,
2. Process, and
3. Tools.

The Air Force, in a similar study of system program office (SPO) personnel reported that "HSI is motherhood and apple pie, but

1. A strong advocate for HSI is needed along with well defined HSI policy and processes,
2. Trained HSI personnel, and
5. Tools to perform HSI analyses."

DOD 5000.2-R, Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs, 4 January 2001, now serves as the strong advocate and provides the high-level policy and process.

DOD 5000.2-R requires among other things, the following:

For all programs regardless of acquisition category, the PM shall initiate a comprehensive strategy for HSI early in the acquisition process to minimize ownership costs and ensure that the system is built to accommodate the human performance characteristics of the user population that will operate, maintain, and support the system. The PM shall work with the manpower, personnel, training, safety and occupational health (see 5.2.10), habitability, survivability, and human factors engineering (HFE) communities to translate the HSI thresholds and objectives in the operational requirements document (ORD) into quantifiable and measurable system requirements. The PM shall include these requirements in specifications, the Test and Evaluation Master Plan, and other program documentation, as appropriate, and use them to address HSI in the statement of work and contract. The PM shall identify any HSI-related schedule or cost issues that could adversely impact program execution.

DoD policy stresses the importance of optimizing total system performance while minimizing cost through a total systems approach. The total system includes not only the hardware, but the people who operate and maintain the system. Utilizing the above policies and processes, as well as similar Canadian policies and procedures, HSI practitioners must assist with the total system approach by focusing attention on the human in the system.

The time is now for Human Systems Integration! We have the support, the policy, the processes, the people, and the tools. Decision makers now realize that to fight tomorrows wars, the needs and capabilities of the warrior must be taken into account during system design. The issue is not if we are to use HSI in the acquisition process, but how can we ensure that we get the most out of the process.■

The U.S. Army's Manpower & Personnel Integration (MANPRINT) Program: Yesterday, Today and Tomorrow

Dr. Bob Holz

The U.S. Army is presently engaged in what many (both within and outside the military) are calling a revolution. This revolution, referred to as "Army Transformation," is creating a ground force that is more deployable, more survivable, more lethal, and can fight and win across a full spectrum of potential conflicts.

The last time the Army found itself in the throes of a similar revolution was in the mid-1980s when, under then President Ronald Reagan, the Army began a major modernization program resulting in the fielding of the Abrams tank, the Bradley fighting vehicle and the Apache helicopter. Then, as today, the basis for the revolution was founded in the recognition that in order to ensure relevance on the future battlefield, the Army had to transform itself.

A consequence of the 1980s modernization program for the Army was the creation of the MANPRINT program. This program was created when it was realized that the Army was designing, developing and fielding weapons and weapons systems that failed to take into account the role that the soldier, the leader, and the unit would play in terms of the employment of that system.

The application of MANPRINT analyses to some of the Army's major acquisition systems in the 1980s and 1990s resulted in significant cost savings and, more importantly, in design improvements that in turn resulted in systems that were both more effective and more efficient. Examples include the use of thermal sights on the Abrams tank, the need for a two-person crew for the Apache, design changes to the FOX chemical vehicle, and the complete redesign of the wire guided antitank missile, Dragon, into the "fire and forget" missile, Javelin.

Today's transformation initiatives envision designing, developing and fielding entirely new platforms (both for weapons and with information systems) that will rely heavily on robotics, artificial intelligence, stand-off non-line-of-sight ordnance, and robust command, control, communications, computers intelligence surveillance and reconnaissance (C4ISR) capabilities. However, regardless of the technologies that will become an integral part of the Army's "objective force," the soldier will remain the centerpiece of all transformation efforts.

An Army Brigade in 2010 will possess capabilities that today do not exist at Division and higher levels. Fighting platforms will weigh less than 20 tons to permit loading and transport using C–130 assets. As a function of this lighter weight (less armor for protection), the platforms will require the ability to see the enemy before the enemy even knows the platform is on the ground. Further, to reduce risk to our soldiers, these platforms will make use of both line-of-sight and non-line-of-sight ordnance. Robots will play a major role for tomorrow's Army, both in terms of sensors designed to keep soldiers out of harm's way as well as sensor-to-shooter links designed to increase the accuracy and "first-hit equals kill" capabilities of tomorrow's direct and indirect weapons.

The soldiers of tomorrow's Army will be linked together in a seamless information network that will provide

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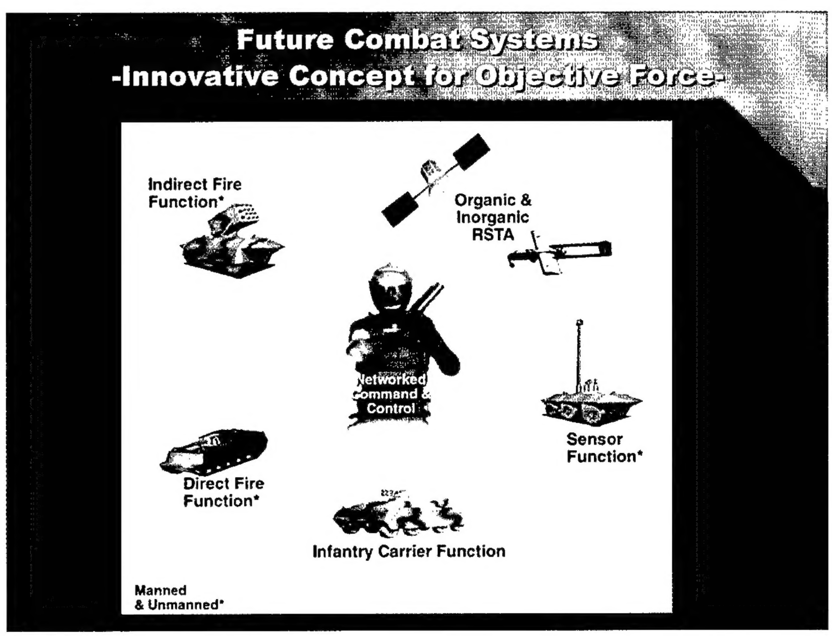

Figure 1. Future Combat Systems

Human Systems Integration (HSI) in the U.S. Navy's System Acquisition Process

Thomas B. Malone, Ph.D.

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The beginning of the 21st century is witnessing radical changes in the way naval warfare is being processed. These changes extend to new ways of waging war, including use of joint, highly coordinated, quick response operations, and the associated need for information warfare and network-centric, open architecture, distributed combat systems. Changes in modern naval warfighting also include new threats, involving aggressive actions of smaller, dispersed, highly mobile and lethal forces of rogue nations and terrorists, such as the attack on the USS COLE. Another significant change is in the tactical environment for naval operations, from the "blue water" of the open ocean, with ample early warning on the onset of attacks, to the "brown water" of the littoral regions where tomorrow's sea battles will be fought, where reaction time is severely limited and where simultaneous multi-dimensional warfare (land, air, surface, and subsurface) can be expected. Finally, change in Navy systems of tomorrow is dictated by the severe and continual reductions of defense budgets, leading to increase automation of systems and further reductions in manpower. Finally, change in Navy systems of tomorrow is dictated by the severe and continual reductions of defense budgets, leading to increased automation of systems and further reductions in manpower.

The result of these changes in the nature of naval warfighting, and warfare systems, is a new appreciation for the requirements, capabilities, roles, and value of humans in Navy systems. The Director of Surface Warfare in the Office of the Chief of Naval Operations (CNO) recently concluded that we must "change the way we design our ships and installed systems by institutionalizing human-centered design, human systems integration, and detailed front-end analysis of all manpower and training requirements." The CNO himself, in defining his priorities for the naval service, directed that the Navy must create a lifestyle of service that is attractive to bright, ambitious young men and women, and must enhance quality of service, which he defined as a combination of quality of life and quality of work. An excellent example of how changes in naval warfare, and increased attention to the human in the system, are being implemented in the Navy can be seen in the acquisition of the ZUMWALT class destroyer, DD 21.

DD 21 ships must possess the operational flexibility to meet the multimission forward presence and warfighting requirements of the littoral environment and employ a nearly "puncture proof" self defense capability against all varieties of threats envisioned in the 21st century. The DD 21 ships must also be capable of exploiting advances in information technologies through automation and system architectures capable of disseminating information to widely dispersed and dissimilar units to achieve an overall dominant maneuver concept of operations. The DD 21 ship and systems must also focus on requirements for human performance in using information products to support situation awareness and maintaining tactical perspective, interaction with automated systems, generation and dissemination of knowledge as well as information, and managing the mission. One of the DD 21 key performance parameters (KPP) is to reduce ship manning by over 70 percent compared with existing ships while maintaining a high level of human performance capability, human safety, and quality of life for the crew.

Without the extensive and intensive application of HSI in its acquisition, the DD 21 could not successfully meet its mission. The specific methods and processes being applied in DD 21 acquisition are:

1. Human-centered design, embracing development of concepts for reducing human work-

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The U.S. Air Force
Human Systems Integration Program
"Pay Me Now... Or Pay Me Later"

Richard A. Young
Deputy Chief, Air Force Human Systems Integration Office

Over the decades, and for the foreseeable future, the Air Force has faced ever-decreasing manpower and funding issues. Under that environment we must continue to find ways to field systems that are more cost-effective over the long-term. We can no longer live with the old paradigm of "field it and fix it," for we no longer have the money or manpower to do that.

The goal of the Air Force Human Systems Integration (HSI) program is to optimize total system performance at acceptable costs and within human support constraints. This process is achieved by the continuous integration of seven human-related considerations (known as HSI elements) in relationship with the hardware and software components of the total system, and with each other, as appropriate. HSI elements include manpower, personnel, training, human factors, safety, health hazards, and survivability. HSI is a comprehensive management and technical program that focuses attention on human capabilities and limitations throughout the acquisition system's life cycle. HSI element support actions are initiated during concept development, test and evaluation, documentation, design, development, fielding, post-fielding, operation and modernization of the system(s).

The Air Force HSI Program evolved over the years from a series of inspections, regulation reviews and directive implementations. In 1981, a GAO report and a Defense Science Board study endorsed adequate manpower, personnel, and training (MPT) analyses and "centralized control of MPT factors."

In 1985–86, Congress required manpower requirements be submitted for systems at the Milestone I and II decision points, along with a statement about how the system would be fielded if additional personnel were required but not available. The Secretary of Defense directed that MPT be expanded to include; "Safety." This led to the establishment of the Aeronautical Systems Division (ASD)/ALH Directorate for Manpower, Personnel and Training. In 1988 the beginnings of an HSI type program named the Integrated Manpower, Personnel, and Comprehensive Training and Safety (IMPACTS) program was located under HQ USAF.

A 1996 Air Force-wide HSI Process Action Team recommended overarching HSI implementation. As a result, the AFMC Commander established an eight-person HSI Cadre at Brooks Air Force Base in October 1996. The initial responsibilities of this organization were to:

1. Educate and train all AFMC managers and appropriate acquisition personnel on the importance and implementation of HSI throughout the acquisition process;
2. Assist all AFMC agencies, IPTs, etc., in planning, programming and implementing HSI in all new and modified systems;
3. Identify pervasive HSI problems throughout the Air Force and focus advocacy and support to fix these problems; and
4. Work to maintain solid advocacy for HSI at the Air Force, Air Staff and DoD levels, and for consistent compliance with existing HSI policy and direction.

In June 2000, LtGen Stephen Plummer, SAF/AQ, directed the Air Force acquisition community to include HSI as part of their briefings in preparing system program offices for the Acquisition Strategy Panel. He urged all Air Force acquisition planners to work with the Brooks HSI office, and emphasized that efforts to raise the awareness of HSI will be "an important step in optimizing operational effectiveness while minimizing total ownership costs of Air Force weapon systems."

Although each service acquires, operates and maintains its weapon systems independently, and each reviews the

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URL: http://xrs10.brooks.af.mil/xrc

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calendar

jul

Fairfax, VA, USA. July 26–28, 2001
ICCM 2001; 4th International Conference on Cognitive Modeling
Contact Christian Schunn, Applied Cognitive Program, MS 3F5, George Mason University, Fairfax, VA 22030–4444. E-mail: schunn@gmu.edu, URL: http://hfac.gmu.edu/~iccm

aug

Maui, HI, USA. July 28–August 2, 2001
CAES 2001: International Conference on Computer-Aided Ergonomics and Safety
Contact Waldemar Karwowski, Center for Industrial Ergonomics, Academic Building, Room 445, University of Louisville, Louisville, KY 40292. Tel: +1–502–852–7173, Fax: +1–502–852–7397, E-mail: karwowski@louisville.edu, URL: http://www.ergonet.net/caes2001.html

Edinburgh, Scotland. August 1–4, 2001
23rd Annual conference of the Cognitive Science Society
Contact URL: http://www.hcrc.ed.ac.uk/cogsci2001

New Orleans, LA, USA. August 5–10, 2001
HCI International 2001. 9th International Conference on Human-Computer Interaction
Contact Kim Gilbert, School of Industrial Engineering, Purdue University, 1287 Grissom Hall, West Lafayette, IN 47907–1287, USA. Tel: +1–765–494–5426, Fax: +1–765–494–0874, URL: http://hcii2001.engr.wisc.edu

Chapel Hill, NC, USA. August 6–8, 2001
Ergonomics in the Workplace
Contact North Carolina Occupational Safety and Health Education and Research Center, University of North Carolina at Chapel Hill, School of Public Health, 3300 Highway, 54 W, CB# 8150, Chapel Hill, NC 27516. Tel: +1–919–962–2101, Fax: +1–919–966–7579, URL: http://www.sph.unc.edu/oshecrc

Chapel Hill, NC, USA. August 8–10, 2001
Ergonomics for Production Facilities
Contact North Carolina Occupational Safety and Health Education and Research Center, University of North Carolina at Chapel Hill, School of Public Health, 3300 Highway, 54 W, CB# 8150, Chapel Hill, NC 27516. Tel: +1–919–962–2101, Fax: +1–919–966–7579, URL: http://www.sph.unc.edu/oshecrc

of events

Look for the Human Systems IAC exhibit at these meetings!

San Diego, CA, USA. August 13–16, 2001
Principles of Ergonomics
Contact OSHA Training Education Center, UCSD North County Center, 15373 Innovation Drive, Suite 105, San Diego, CA 92128–3424. Tel: +1–858–451–7474, Fax: +1–858–451–7481, URL: http://osha.ucsd.edu

sep

Nashville, TN, USA. September 17–19
2001 SAFE Annual Symposium
Contact SAFE Association, P.O. Box 130, Creswell, OR 97426–0130, USA. Tel: +1–541–895–3012, Fax: +1–541–895–3014, E-mail: safe@pond.net, URL: http://www.safeassociation.org, http://www.safeassociation.com

Kassel, Germany. September 18–20, 2001
8th IFAC/IFIP/IFORS/IEA Symposium on Analysis, Design, and Evaluation of Human-Machine Systems (HMS 2001)
Contact Gunnar Johannsen. E-mail: hms2001@imat.maschinebau.uni-kassel.de, URL: http://www.imat.maschinenbau.uni-kassel.de/hms2001/time2.html

oct

Minneapolis, MN, USA. October 8–12, 2001
45th Annual Meeting of the Human Factors and Ergonomics Society
Contact HFES, P.O. Box 1369, Santa Monica, CA 90406, USA. Tel: +1–310–394–1811, Fax: +1–310–394–9793, E-mail: hfes@compuserve.com, URL: http://hfes.org
Proposals due March 19, 2001

nov

Monterey, CA, USA. November 2001
47th Biennial Meeting of the U.S. Department of Defense Human Factors Engineering Technical Advisory Group
Contact Sheryl Cosing, 10822 Crippen Vale Court, Reston, VA 20194, USA. Tel: +1–703–925–9791, Fax: +1–703–925–9644, E-mail: sherylynn@aol.com, URL: http://dticam.dtic.mil/hftag/. *Meeting is open to all government personnel and others by specific invitation.*

Orlando, FL, USA. November 26–29, 2001
Interservice/Industry Training, Simulation, and Education Conference
URL: http://www.iitsec.org for information

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SAFE Association

Story by Christy Cornette

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SAFE members represent diverse backgrounds and fields of expertise. Financially, SAFE depends solely on the dues of its corporate and individual members as well as the annual symposia. The Association has various chapters located throughout the U.S. and abroad that meet and promote its goals and objectives. The chapters are a key element to the strength and growth of SAFE.

The Association's goals include stimulating safety and survival research and development. This is accomplished by means of an annual symposium, educational scholarships, association achievement awards, newsletters, and technical publications. SAFE strives to provide its members with opportunities for professional development, achievement, and recognition. Another important objective is to educate the public, industry, and the government to improve human effectiveness and safety in system designs and operation.

The SAFE Association's annual highlight is its symposium, which brings together a broad mix of technical personnel from all over the world, most importantly the users, to network and interact. It serves as a forum to promote new concepts and products, exchange technical information, and discuss special interest issues. Exhibits, technical papers, panels, product demos, outstanding keynote speakers, and workshops are all part of the symposium.

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For further information about SAFE, please contact:
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URL: http://www.safeassociation.com
http://www.safeassociation.org

Human Systems Integration (HSI) in Policy and Practice: A Canadian Perspective

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Ottawa, Ontario
Mr. M. Greenley
Options, Inc. Consultants
Waterloo, Ontario, and
Mr. D. Beevis
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In the Canadian Department of National Defence (DND), support for HSI is derived from lessons learned from previous projects coupled with growing concerns about life-cycle costs. Key HSI issues were first included in the Department's guidelines for Material Acquisition and Support (MA&S) issued in 1999. In response to requests from acquisition projects and to support those preparing the Statements of Requirements (SORs) that are key initial MA&S documents, Defence Research and Development Canada (DRDC) is developing and supporting a centralized, tri-service, HSI Initiative.

Major limitations in the initiative are that no new resources are available and the HSI skill base in DND and in Canada is fragmented and of limited depth. Thus, of necessity, the initiative involves linking existing but dispersed personnel and analytical capabilities through electronic means to:

1. Share and reuse HSI analyses,
2. Link analyses, performance requirements and measures, and evaluation techniques,
3. Introduce all domains earlier in the MA&S cycle,
4. Integrate HSI into the mainstream of the acquisition process,
5. Share and integrate R&D activities related to HSI, and
6. Realize cost savings through all of the above, while adding value through more effective consideration of human centered requirements.

The initiative has three primary components:

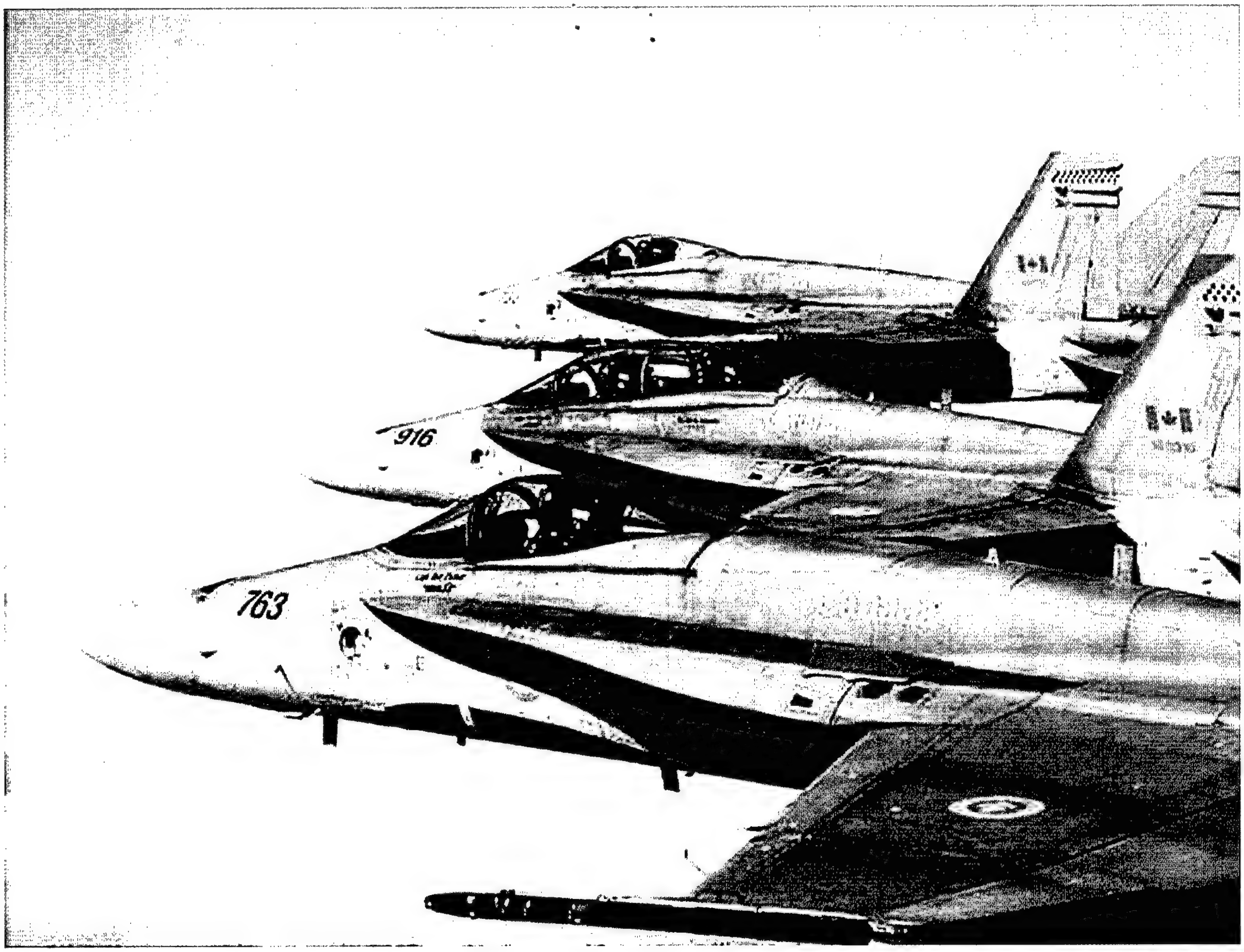
1. People,
2. Process, and
3. Tools.

The "People" include HSI domain representatives throughout DND who are being formed into a "virtual team" of HSI specialists through electronic media links. It is intended that the team will support acquisition projects in one of three ways: either the project will staff and conducts its own analyses, the project will obtain its own HSI contractors, or the project will ask the "virtual team" for support. A DND HSI Board of Advisors is to be formed to support the initiative. A directory of HSI points of contact in industry will be developed by voluntary submission of information. Advisors will be sought from the HSI industrial base once the directory is established.

In interviews, general reactions of the DND HSI specialists have been that they support the initiative but they need hard products to focus on. One product, a "top level" HSI "Process" has been drafted and is being developed further. Requirements are that it be simple, sequenced, provide links, show interactions between HSI domains, accord with the Canadian Defence Management System, map onto the larger DND acquisition process and the Life Cycle Material Management system, and accommodate both developmental and COTS acquisition projects.

A number of analysis, models, and simulation "Tools" are used in HSI activities throughout DND, such as Safework, HEART, SOLE IPME, HFE Guide, and HFE ICADD, (see http://www.crad.dnd.ca/hsi/tools e.html). These tools will be further developed to support HSI activities, and others will be added on an opportunistic basis. The tools will also be used to develop libraries of HSI analyses and simulations.

DRDC has established an HSI Web Site to provide information to both project personnel and the HSI community (see http://www.crad.dnd.ca/hsi-toc e.html). The Web site will be linked to the



electronic Acquisition Desktop later this year so that requirements officers preparing SORs have immediate access to information amplifying HSI issues. It is also planned to introduce an electronic newsletter to which any HSI specialist can contribute.

One other aim of the DRDC HIS initiative is to estimate and document the impact of HSI on the acquisition and life-cycle costs of systems and equipment in relation to:

1. Costs saved,
2. Costs avoided, and
3. Tradeoff opportunities.

To make the necessary observations, DRDC collaborates with project managers to identify and contract the required HSI support activities, on the understanding that the contractors' experience will also be used for case studies.

Early results of these efforts indicate that this centralized approach with a virtual HSI Support team in DND will support early and effective consideration of HSI as well as the cost-effective integration and reuse of models, simulations and analyses between the various domains.■

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David Beevis MSc, P.Eng. works at the Defence and Civil Institute of Environmental Medicine, Toronto specializing in human factors integration in acquisition projects. He is the Leader of the R&D Thrust in Human Factors of Military Systems run by Defence Research and Development Canada, to support the Canadian Department of National Defence.

University of Dayton (UD) and University of Dayton Research Institute (UDRI)

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UD develops innovative technologies and methods to improve the Human-System Interface, cuts training costs while improving learning quality, and implements technology optimizing the system and human performance. The UD Psychology Department and the UDRI Human Factors (HF) Group are key players in HSI.

The UD Psychology Department offers a masters degree in Experimental-HF Psychology. This program stresses knowledge integration and application of psychology to the development of systems, interfaces, and work environments; and uses HF tools for design, test, and evaluation. Internships with Dayton-area firms and Wright-Patterson Air Force (AF) Base agencies provide practical opportunities for applying course-based knowledge. A sample of UD HSI projects follows:

1. A UD masters thesis developed and validated a strategy for developing computer icons. When compared with the more traditional icon development method, the focus group method developed icons more efficiently and effectively.
2. UD and Embry Riddle Aeronautical University faculty collaborated to determine the effectiveness of PC-Based Flight Simulation for the Federal Aviation Administration (FAA). They found that Instrument Flight Rules (IFR) skills could be taught as well on a PC simulator as on more costly fixed-based flight training simulators. This finding contributed to the FAA's approval of PC-based IFR training in FAA Advisory Circular AC-61-126. Currently, 10 PC-based instruction hours can be earned in PC-based simulators (which cost \$4,500 versus ~ \$60,000 for traditional IFR simulators).

Since the 1960s, UDRI has conducted HSI-related research, including the pioneering development of COMBIMAN, Crew Chief, human ejection seat and vibration tolerances, and UDRI was the initial operator of the Crew Systems Ergonomics Information Analysis Center (CSERIAC) for the Defense Technical Information Center.

The UDRI HF Group provides specialized HSI support to the Air Force Research Laboratory Logistics Readiness Branch (AFRL/HESR), whose mission is to improve the planning, readiness, deployment, and logistics information systems. UDRI designs interfaces, evaluates applications, analyzes performance, and recommends solutions. UDRI assists with lessons learned application; incorporating HF into design; conducting usability testing for human-computer interfaces (HCI); and developing field test plans and analyzing data.

For example, UDRI is helping AFRL/HESR examine HCI issues for the LOgistics Control and Information Support (LOCIS) program and the Joint Expeditionary Forces eXperiment (JEFX 2000). UDRI has developed wing-level command and control information visualizations, performed hardware trade studies, and conducted usability testing. Further, UDRI is helping incorporate proactive decision support methodologies, and advanced user interface concepts to improve LOCIS program capabilities. The Status-At-A-Glance information visualizations provide commanders with the ability to quickly evaluate the health of their fleet (see Figure 1).

Other HF Group members demonstrate that the mission relevance of advanced training systems, and their meeting warfighter needs, is best achieved with objective metrics that can highlight mission performance changes. While easier to implement, traditional, academically oriented evaluations are often not clearly tied to mission objective achievement, and do not demonstrate impacts of training on job performance. Therefore, UDRI assisted AFRL's Warfighter Training Research Division

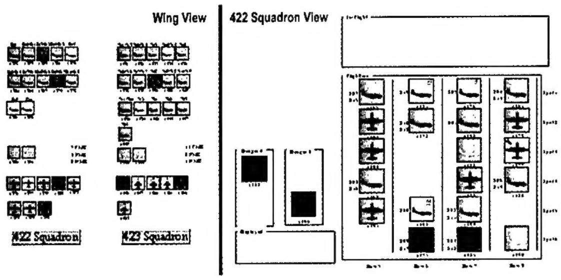

Figure 1. Notional example of LOCIS decision aid being evaluated for HCI.

(AFRL/HEA) in developing effectiveness measures tied to AF Mission Essential Tasks, and developed a Taxonomy of Measures of Effectiveness and Performance for Aircrew and Aircraft Maintainers. Teaming with small businesses, UDRI is developing metrics to build aircrew evaluation tools for the new AF Distributed Mission Training (DMT) networked simulation environment (see Figure 2, a DMT debriefing where Mission Oriented Performance Metrics are being tested).

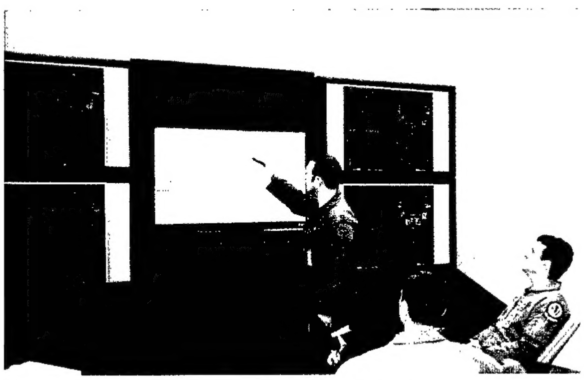

Figure 2. DMT exercise debrief at AFRL/HEA Mesa facility.

Both UD and UDRI strive to invent and develop HF solutions that truly integrate the human into military and civilian systems, while making these systems more efficient, sustainable, cost effective, and accident free.■

Obituary

Anthropometry pioneer Charles E. Clauser died on Sunday, 24 June 2001. Clauser joined the Anthropology Branch of the Aerospace Medical Laboratory at Wright-Patterson Air Force Base in 1958. During his tenure there he was responsible for the conduct and direction of research in anthropometry and biomechanics. He was involved in every large-scale anthropometric survey conducted during the 1960s, 70s, and 80s. He led the Anthropology Group and later became chief of the Anthropology Branch, and retired with 30 years of government service.

While NASA was formed in October 1958, it took a few years to build up its facilities. As a result, the original seven Mercury Astronauts trained at Wright-Patterson AFB. Clauser was on the committee that selected the first seven astronauts, and was involved in their training and fit of space suits and helped design other personnel protective equipment.

In 1972, Clauser established the world's first computerized anthropometric database of U.S. and Allied military personnel. It provided the capability to use standard computer analysis programs to apply these data to design of equipment. Because of their large sample sizes and large number of measures, these computer databases are still being used today, distributed by Human Systems IAC. Clauser initiated a joint Air Force, NASA, and FAA program to measure and model the mass of the human body and its segments. These data and models are still used today by human modelers.

After his retirement from WPAFB he joined the Anthropology Research Project (now Anthrotech) in Yellow Springs. In this capacity he assumed a major responsibility for other anthropometric surveys that were undertaken in the U.S. through the 1980s. His contributions over more than 30 years are well known in the fields of anthropometry and biomechanics.■

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The U.S. Army's Manpower & Personnel Integration (MANPRINT) Program: Yesterday, Today and Tomorrow

instantaneous situation awareness (knowledge of where allies and enemies are located) and will also communicate back to medical personnel when a soldier is injured, providing all critical information needed for triage.

The role that MANPRINT must and will play in the design, development and fielding of these platforms and systems is more critical today than it was 25 years ago.

Applying MANPRINT practices to the design of the Comanche helicopter resulted in over $3.5 Billion in cost avoidance. Similarly, MANPRINT design criteria have been effectively used in the development of the Crusader artillery system.

The ability of soldiers (at all levels) to assimilate the vast quantity of information that the robust C4ISR systems will bring and translate this information into knowledge for better decision making will require close coordination between the computer gurus and the end user. It is this close interface between developer and user that has characterized the Force XXI Battlefield Command and Control for Brigade and Below (FBCB2) system already being fielded to the first digitized division.

The employment of non-line-of-sight weapons (i.e., kinetic energy missiles) will provide significant enhancements in terms of survivability of the shooter but will also increase the risks of fratricides if advanced friend-or-foe identification systems are not developed simultaneously.

The infantry soldier of tomorrow will be equipped with a personal computer, enhanced night vision devices, an individual weapon capable of literally shooting around corners (for use in urban settings), as well as links to robots and unmanned vehicles that will provide a "God's eye view" of the battlefield.

Ensuring that each of the piece-parts of tomorrow's transformed Army work to their design specifications and include the soldier will require the application of MANPRINT analyses and practices early on in system design and development. To ensure that this requirement takes place in a planned fashion, the Army has directed that subject matter experts from each of the MANPRINT domains (manpower, personnel, training, human factors engineering, soldier survivability, system safety, and health hazards) are made an integral part of the engineering teams that are designing tomorrow's systems.

By ensuring the early (pre-Milestone A) involvement of MANPRINT practitioners today, the Army will reap the rewards of better designed, more effective, and more efficient systems that will ensure the primacy of our land forces tomorrow and beyond.■

continued from page 4
Human Systems Integration (HSI) in the U.S. Navy's System Acquisition Process

load, through function automation, consolidation, elimination, and simplification, and detail design of human-machine interfaces and embedded training capabilities;

2. Top down function analysis, including the human engineering processes of function analysis and allocation, definition of the roles and functions for humans and automation, and analysis of human tasks and workload, skills and knowledge needed to conduct these tasks; and
3. Test and evaluation activities, including modeling and simulation, human and team in the loop simulation, and verification and validation of design concepts.

The Navy is in the process of formalizing the application of HSI to naval systems. The Secretary of the Navy's Instruction 5000.2C (draft) describes the methods and data needed to apply HSI, and identifies the requirements for an HSI Plan to govern the way in which HSI is applied in system acquisition. Thus, the Navy recognizes that to fight tomorrows wars with tomorrow's technology, the requirements and capabilities of the Sailor must be central to the systems' design and the effort to acquire these systems.■

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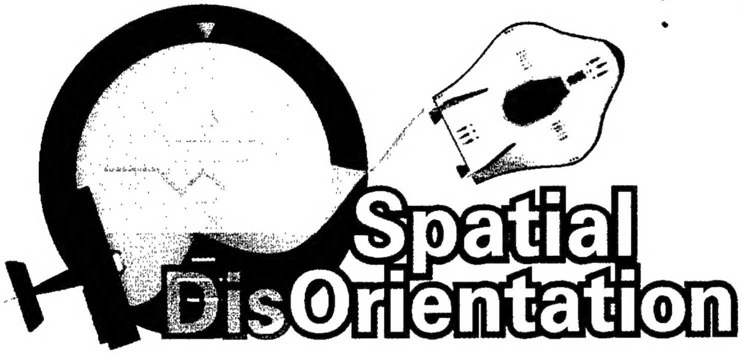
The U.S. Air Force Human Systems Integration Program "Pay Me Now... Or Pay Me Later"

others' requirements documents to determine joint applicability; lessons learned information during acquisition have often not been shared. Performance, along with cost and schedule, has always been given the primary consideration in acquisition, often however, at the expense of supportability and affordability. HSI in the Air Force has fought an uphill battle since the day of its inception.

Acquisition leadership at the DoD level has shifted direction to increase the emphasis placed on human systems integration with the knowledge that it will produce significant costs savings in long-term cost-of-ownership. It is possible for the acquisition paradigm to meaningfully include human supportability/operability as a decision criteria, along with cost, schedule and performance. As we face mandated resource cuts, smaller recruiting pools, and more changes in the Air Force structure, we must shift attitudes and take the actions that HSI requires. But the time has finally come, along with the mandatory HSI implementation requirements of the new DOD 5000.2-R. The issue is not if we are to use HSI in the acquisition process, but how it is used and who will do the work.■



Spatial DisOrientation

Major Todd Heinle

Since the beginning of manned flights, pilots recognized the need to maintain awareness of both aircraft attitude and the spatial relationship of the aircraft to their surroundings. In the early days, this awareness was almost instinctive, but over time it became apparent that a certain amount of training would be required. As the complexity and performance of aircraft evolved, and mission demands grew, it has become more important for an organized, structured approach to achieving and maintaining spatial orientation. To this end, individuals from across the spectrum, academia to researchers, aircraft designers to pilots, and everyone in between, have developed different methods of countering spatial disorientation (SD).

The three main approaches that have evolved are better training, improved cockpit displays and devices, and an increased understanding of the physiological mechanisms of orientation. Each approach has achieved significant progress, but a common barrier for all is simply the availability of relevant information.

To address this shortcoming, the Air Force Research Laboratory's (AFRL) Human Effectiveness Directorate has instituted a Spatial Disorientation Counter-Measures (SDCM) program. A key feature of the program is a comprehensive web site (http://www.spatiald.wpafb.af.mil) accessible to the public utilizing some of the latest advances in knowledge management software. The current capabilities of the site make it a useful tool for all who are working the SD problem.

The SD Tutor on the site has the AFRL Technical Report AL-TR-1993-0022, authored by Dr. Kent Gillingham and Dr. Fred Previc. This publication was optimized for use on the web site and is an excellent reference for anyone desiring a technical understanding of SD.

Other capabilities of the site include a reference database of SD-related publications, a forum section for the interchange of ideas and questions regarding various aspects of SD, a new research projects area where cutting-edge innovation can be showcased, and links to other SD-related organizations.

Additionally, the SD site will soon provide down-loadable training modules for use by instructors in all phases of flying training. These training modules will include slides and notes for instructors to use in the classroom. The goal is to provide high quality instruction materials that are current and relevant to all members of the flying community.

The SD web site is provided for a broad spectrum of potential users. Training functions within the operational commands will have a ready source for presentations. Both civilian and military aircrew members will now have a direct pipeline to the experts in the research and development community. Individuals in the academic world will have a single location to search for relevant SD-related materials. Those involved in research will be able to easily find others working in similar areas, sparking the development of synergistic programs. Authors looking for an alternate venue for their publications are welcomed to use the SDCM web site.

If you are involved in the flying community, you need to be aware of the dangers of SD, how common it is to experience, and the latest countermeasures and techniques to help you survive your next encounter. You'll see all this and more when you visit the SD web site.

When you check out the site, please take just a moment to give your impression. We want to make the site useful to you. Let us know what you'd like to see and what needs to be improved. Your opinion is as important to us as it is to you.

For further information, please contact:

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